CPE/EE 322
Engineering Design VI
Lesson 5: Acquiring, Applying, and Protecting Technical Knowledge

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Outline

1. Science: the foundation of technical knowledge
2. Sources of technical knowledge
3. Protection of intellectual property (IP): trade secrets, trademarks, copyrights, and patents

Objectives

G. Voland, Engineering by Design, Chapter 5

- Explain the importance of scientific and technical knowledge in the practice of engineering
- Recognize the need to be familiar with many different sources of technical information such as engineering manuals, manufacturers' catalogs, books, magazines, journals, and patents
- Distinguish between three distinct types of property: real, personal, and intellectual
- Discuss the advantages and disadvantages of the following mechanisms for protecting intellectual property: trade secrets, trademarks, copyrights, and patents
- Distinguish between utility, design, and plant patents
- Define the principal criteria (novelty, nonobviousness, and usefulness) used to evaluate utility patent applications
- Recognize that engineers and inventors should maintain careful records in anticipation of patent applications
- Recognize that patent protection is based on the claims contained in the patent disclosure
- Find encouragement in the fact that many creative people without technical training have been awarded patents

Lab 5 — Paho-MQTT

- Study the GitHub repository Lesson 5 labs
- Install Paho-MQTT
- Change directory to the iot repository
- Update the repository with git pull
- Change directory to Lesson 5
- Run python3 subcpu.py on one Terminal
- Run python3 pubcpu.py on another

Assignment 5 — Intellectual Properties

Search and include relevant results of the proposed design for any of the following:

- Trademarks (or service marks)
- Copyrights (or licenses)
- Patents (or standards)

Program Outcome 7: (Ability to Learn)
1.1 (Tools) Students will be familiar with the use of standard search engines and keywords for an undirected search for information relevant to a specific project, familiar with the use of directed searches, starting from a known-good site and searching for information at that site relevant to a specific project and familiar with resources for compression/decompression of information.

Scientific Knowledge and Applications

Counterweights and balances	Elevators, shadoofs, block and tackle systems, and tower cranes
Inclined planes	Wedge devices (axes, chisels, shovels, plows), and spiral screw systems
Joule effect	Incandescent electric lights
Levers	Balances, crowbars, pliers, wheelbarrows, nutcrackers, tweezers, and fishing rods
Magnetism	Turbines, motors, and metal detectors
Newton's first law	Jet planes and rockets
Photovoltaic effect	Photovoltaic, photoelectric, and solar cells
Piezoelectric effect	Quartz watches
Pressure differences	Airspeed indicators, siphons, and anti-siphon valves
Sublimation	Freeze-dried coffee
Unique physical characteristics	Coin testers and paper money testers such as a counterfeit banknote detection pen
Wave phenomena	Radar guns, eyeglasses, microscopes, one-way mirrors, telescope, acoustical designs, and touchscreen monitors
Binary notation	Computers

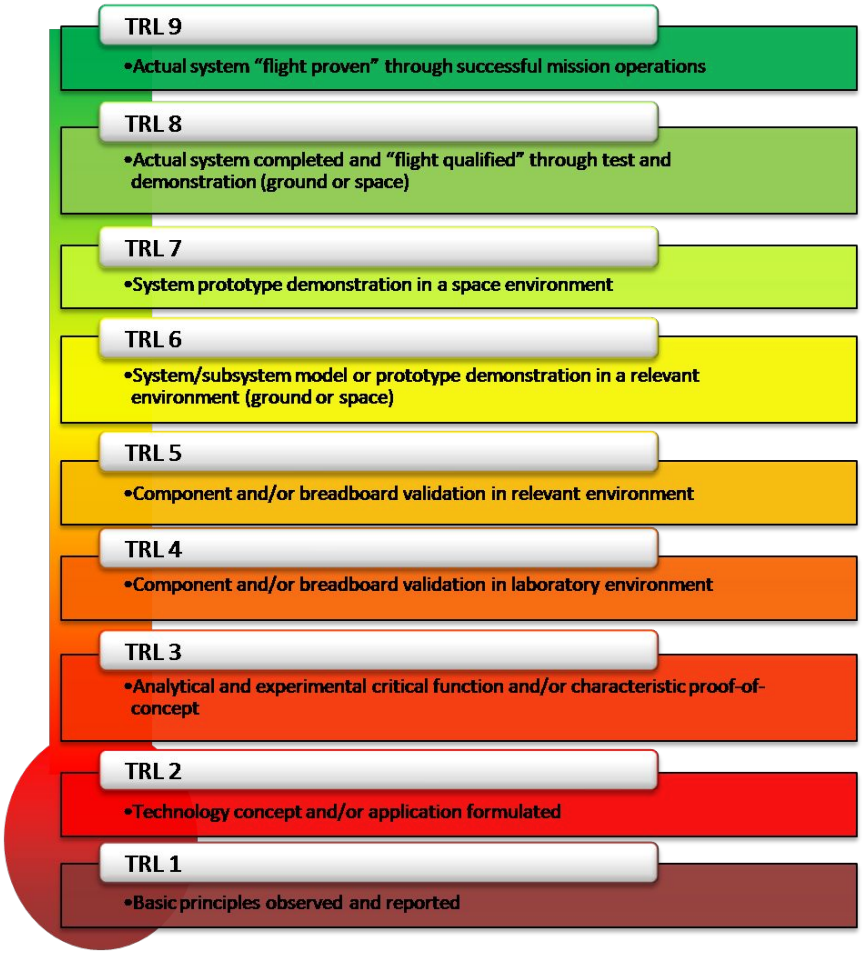
Resources of Technical Knowledge

- Index of Federal Specifications, Standards and Commercial Item Descriptions
- National Institute of Standards and Technology (NIST)
- International Organization of Legal Metrology (OIML)
- International Bureau of Weights and Measures (BIPM)
- Merck Manuals of Medical Information for the Professional
- Pew Research Center
- National Fire Protection Association (NFPA) National Electric Code (NEC)
- American National Standards Institute (ANSI)
- IEEE Standards Association, Standards University, and GET Program
- IETF Request for Comments (RFCs)
- The 3rd Generation Partnership Project (3GPP)
- European Telecommunications Standards Institute (ETSI)
- International Electrotechnical Commission (IEC)
- International Organization for Standardization (ISO)
- International Technology Roadmap for Semiconductors (ITRS)
- International Telecommunication Union (ITU)
- World Wide Web Consortium (W3C)
- MacRae's Blue Book (a collection of manufacturers' catalogs)
- Sweets' Product Catalogs for Building Products
- ThomasNet (supplier addresses classified by product)

AI Resources

- Allen Institute for Artificial Intelligence (AI2)
- Apple Developer Machine Learning
- AWS Machine Learning Blog
- Baidu Research
- Berkeley Artificial Intelligence Research (BAIR)
- DeepMind
- Facebook AI Research
- Google AI
- Google Colaboratory (Jupyter notebook environment)
- HackerRank (technology hiring platform)
- IBM AI Research
- Intel AI Developer Program
- Kaggle (data scientists community)
- Microsoft Research
- One Hundred Year Study on Artificial Intelligence (AI100)
- OpenAI
- The Partnership on AI

Technology Readiness Levels



- Technology readiness levels (TRL) provide a method of estimating technology maturity of critical technology elements of a program during the acquisition process
- TRL are based on a scale from 1 to 9 with 9 being the most mature technology
- Originally conceived at NASA in 1974 and formally defined in 1989
- The original definition included seven levels, but in the 1990s NASA adopted the current nine-level scale that subsequently gained widespread acceptance

Protection of Intellectual Property

Type	Advantages	Disadvantages
Trade Secrets	No time limit Property remains a secret known only to owners Provides legal protection against others attempting to learn the secret	Belongs to owner only if owner can keep it a secret May be legally reverse engineered
Trademarks	Renewable every 5 years Unlimited time limit (simply renew) Provides legal protection	Belongs to owner only if it does not become used generically to identify the product type
Copyrights	The Copyright Term Extension Act (CTEA) of 1998 extended terms to life of the author plus 70 years and for works of corporate authorship to 120 years after creation or 95 years after publication, whichever endpoint is earlier	Time limit although lengthy is nevertheless finite; after the copyright protection has expired, the work enters the public domain Only protects the specific form of expression, not the idea or concept itself
Patents	Utility patents now provide 20 years of protection during which time others are excluded from making, selling, or using the invention	Nonrenewable

Trade Secrets

Trade Secrets

- Trade secrets comprise formulas, practices, processes, designs, instruments, patterns, or compilations of information that derive independent economic value from not being publicly known and with reasonable measures taken to protect the information
- Because protection of trade secrets can, in principle, extend indefinitely, it therefore may provide an advantage over patent protection and other registered intellectual property rights, which last only for a specific duration
- Companies often try to discover one another's trade secrets through lawful methods of reverse engineering or employee poaching on one hand, and potentially unlawful methods including industrial espionage on the other
- Legal protections include non-disclosure agreements (NDAs), work for hire (WFH), and non-compete clauses (NCCs)

Trade Secret Examples

- The Google Search Algorithm: identification of link farms or PageRank manipulation
- KFC (Kentucky Fried Chicken): the original recipe of 11 herbs and spices by Harland Sanders 1890—1980
- Coca-Cola: the formula of flavorings
- Baseball Rubbing Mud by Russell Aubrey "Lena" Blackburne 1886—1968
- *The New York Times* Best Seller List: sales data compilation process
- Listerine: the antiseptic formula developed by Joseph Lawrence 1836—1909 and named in honor of Joseph Lister 1827—1912
- WD-40 (Water Displacement, 40th formula)
- Twinkies: the formula of cream fillings
- Krispy Kreme Doughnuts
- McDonald's Big Mac Special Sauce
- Read more

Trademarks

Trademarks

- Bladesmiths in the Roman Empire are thought as the first users of trademarks
- The first legislative act concerning trademarks in 1266 under the reign of Henry III 1207—1272 required all bakers to use a distinctive mark for the bread they sold
- The lion emblem of Löwenbräu originates from a 17th-century fresco in the brewing house founded in 1383, depicting Daniel in the lions' den
- In France, the first comprehensive trademark system went into effect in 1857
- The Trade Marks Act 1938 of the United Kingdom created an examination-based registration process and application publication system
- The US Lanham Act enacted on 1946-07-05 went into effect on 1947-07-06
- A service mark is a trademark to identify a service rather than a product
- A certification mark indicates compliance with product standards or regulations
- Non-conventional trademarks may be visible (colors, shapes, moving images, holograms, positions) or non-visible (sounds, scents, tastes, textures) signs
- The Trademark Electronic Search System (TESS) provides the United States Patent and Trademark Office (USPTO) database of registered trademarks and pending applications

Trademark Infringement

- Trademark infringement may occur when one party uses a trademark that is identical or confusingly similar to a trademark owned by another party, in relation to products or services that are identical or similar to the products or services that the registration covers
- Courts consider various factors to determine whether a trademark was infringed
  - Whether the plaintiff has a valid trademark because it is officially registered, or because it has a claim under common law
  - Whether the trademark is being used by the defendant
  - Whether the defendant's use of the mark is in commerce
  - Whether that use is connected to the sale, offer, distribution, or advertising of a product
  - Whether the defendant's use of the trademark is likely to confuse consumers, the main topic of debate in most cases
- Trademark dilution is a trademark law concept giving the owner of a famous trademark standing to forbid others from using that mark in a way that would lessen its uniqueness

Genericized Trademarks

- The genericized trademarks include Aspirin, Escalator, Laundromat, Teleprompter, Trampoline, Videotape
- Former trademarks become generic terms: App Store, Dumpster, Touch-tone, Zip code, Zipper
- Protected trademarks frequently used as verbs include Google, Photoshop, Uber, Velcro, Xerox, Zoom
- Protected trademarks frequently used as generic terms: Band-Aid, Bubble Wrap, ChapStick, Coke, Cutex, EpiPen, Formica, Freon, Frisbee, Jacuzzi, Jeep, Jell-O, Jet Ski, Kleenex, Memory Stick, Ping Pong, Play-Doh, Plexiglas, Popsicle, Post-It, PowerPoint, Q-tips, Rollerblade, Roomba, Scotch Tape, Sharpie, Styrofoam, Super Glue, Super Heros, Tarmac, Thermos, Tylenol, Vaseline, Zeppelin, Zipper, Ziploc

Copyrights

Copyrights

- The US Copyright Act of 1790 was signed into law by President George Washington on 1790-05-31
- The Berne Convention for the Protection of Literary and Artistic Works is an international agreement governing copyright that was first accepted in Berne, Switzerland, in 1886
- The US Copyright Act of 1976 went into effect on 1978-01-01
- The Copyright Term Extension Act (CTEA) of 1998 that extended copyright terms was named in honor of Sonny Bono 1935—1998
- The US required registration of copyrighted works before it signed onto the Berne Convention in 1989 while copyright registration remains a prerequisite to filing an infringement suit
- The United States Copyright Office, a part of the Library of Congress, maintains records of copyright registration in the US including a Copyright Catalog
- A copyright transfer agreement transfers the copyright for a work from the copyright owner to another party, e.g., the electronic IEEE Copyright Form (eCF)

Copyright Infringement

- Copyright infringement is the use of works protected by copyright law without permission, infringing certain exclusive rights granted to the copyright holder, such as the right to reproduce, distribute, display or perform the protected work, or to make derivative works
- Copyright infringement disputes are usually resolved through direct negotiation, a notice and take down process, or litigation in civil court
- Egregious or large-scale commercial infringement, especially when it involves counterfeiting, is sometimes prosecuted via the criminal justice system
- Shifting public expectations, advances in digital technology, and the increasing reach of the internet have led to such widespread, anonymous infringement that copyright-dependent industries now focus less on pursuing individuals who seek and share copyright-protected content online, and more on expanding copyright law to recognize and penalize – as "indirect" infringers – the service providers and software distributors which are said to facilitate and encourage individual acts of infringement by others, e.g., Library Genesis or Sci-Hub (not to be confused with Science Huβ)

Digital Millennium Copyright Act

- The Digital Millennium Copyright Act (DMCA) is a U.S. copyright law as of 1998-10-28 that implements two 1996 treaties of the World Intellectual Property Organization (WIPO) and criminalizes
  - Production and dissemination of technology, devices, or services intended to circumvent measures that control access to copyrighted works commonly known as digital rights management (DRM)
  - The act of circumventing an access control, whether or not there is actual infringement of copyright itself
- DMCA heightens the penalties for copyright infringement on the internet
- DMCA amended Title 17 of the United States Code to extend the reach of copyright, while limiting the liability of the providers of online services for copyright infringement by their users
- The Recording Industry Association of America (RIAA) is a trade organization that represents the music recording industry in the United States

Copyright and Software Licenses

Under U.S. copyright law, all software in source code or object code except software in the public domain is copyright protected

- GitHub, GitLab, Bitbucket, Google Open Source
- Open Source Initiative: definition, licenses, and education
- Open-source-software movement
- Open collaboration
- Philosophy of the GNU Project — Free software means that the software's users have freedom to
  - Run the program
  - Study and change the program in source code form
  - Redistribute exact copies
  - Distribute modified versions
- The GNU General Public License (GPL)
- Comparison of free and open-source software licenses
- Software licenses and software patent debate

Copyleft

- Copyleft is a strategy of utilizing copyright law to pursue the policy goal of fostering and encouraging the equal and inalienable right to copy, share, modify and improve creative works of authorship
- Copyleft as a general term describes any method that utilizes the copyright system to achieve the aforementioned goal
- Copyleft as a concept is usually implemented in the details of a specific copyright license
- Copyright holders of creative works can unilaterally choose these licenses for their own works to build communities that collaboratively share and improve those copylefted creative works
- A Collaborator License Agreement (CLA) defines the terms under which intellectual property has been contributed to a company or project, typically open-source software (OSS)

Public Copyright Licenses

- A Creative Commons (CC) license is one of several public copyright licenses that allow creators to communicate which rights they reserve and which rights they waive for the benefit of recipients or other creators
  0. free access, and freedom to use the work as wish ("use" includes to run a program or to execute a music score)
  1. Freedom to access the "source-code" and use it as wish, for study or change it for personal use
  2. Freedom to redistribute copies
  2.1 Right to quote (freedom to redistribute copies of fragments)
  3. Freedom to distribute copies of modified versions to others
- CC restrictions include BY (attribution on 2, 2.1, or 3), SA (shared alike on 2 or 3), NC (non-commercial on 2 or 3), and ND (non-derivative on 3)

Fair Use

- Fair use is a doctrine in the law of the United States that permits limited use of copyrighted material without having to first acquire permission from the copyright holder
- Fair use is one of the limitations to copyright intended to balance the interests of copyright holders with the public interest in the wider distribution and use of creative works by allowing, as a defense to copyright infringement claims, certain limited uses that might otherwise be considered infringement
- Google LLC v. Oracle America, Inc. was a legal case on the use of parts of the Java programming language's application programming interfaces (APIs), which are owned by Oracle (through subsidiary, Oracle America, Inc., originating from Sun Microsystems), within early versions of the Android operating system by Google
- In April 2021, the Supreme Court ruled in a 6–2 decision that Google's use of the Java APIs fell within the four factors (purpose and character of the use, nature of the copyrighted work, amount and substantiality, and effect upon work's value) of fair use, bypassing the question on the copyrightability of the APIs

Patents

Patent History

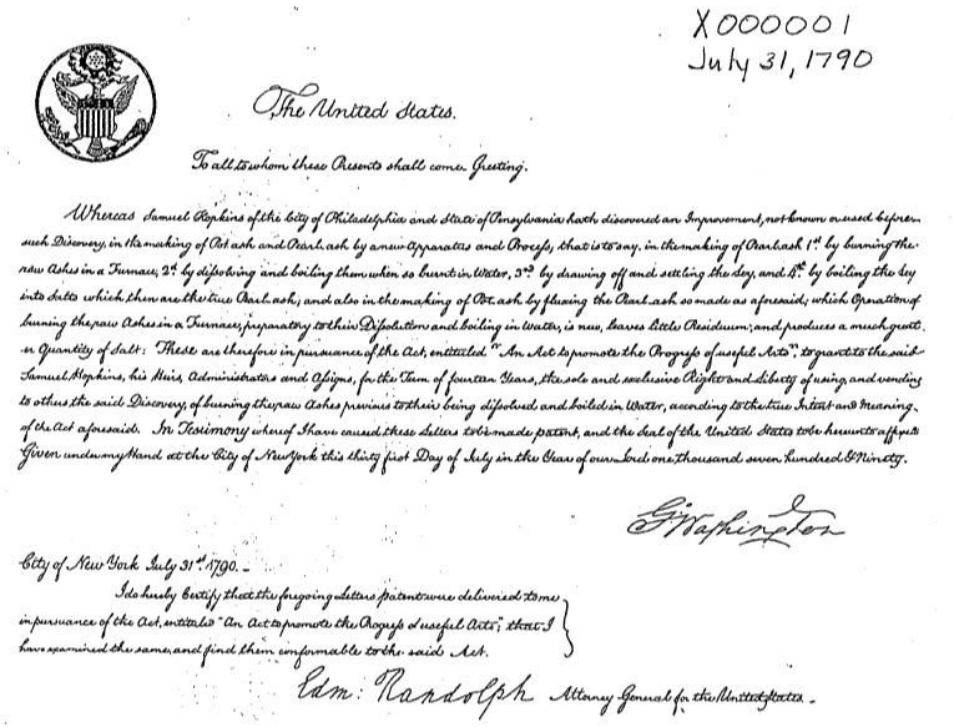
- The word patent originates from the Latin patere, which means "to lay open" and make available for public inspection
- In 1421, a Florentine architect Filippo Brunelleschi (1377—1446) acquired a three-year patent for a barge with hoisting gear that carried marble from Pisa to Florence along the Arno River in 1421 to build the Florence Cathedral
- Patents were systematically granted in Venice as of 1450, mostly in the field of glass making — As Venetians emigrated, they sought similar patent protection in their new homes, which led to the diffusion of patent systems to other countries
- In 1449, King Henry VI (1421—1471) of England issued the first recorded Letters Patent in England with a 20-year monopoly to John of Utynam from Flanders, a master glass-maker who came to England to make the stained glass windows for Eton College with a new method, not yet known in England
- Further reading
  - Patent History by Prof. Catherine Patterson, University of Houston
  - Chapter 2: History of Patents in Europe and the United States, *Introduction to Patent Law* by Prof. Michael Wogan, Rutgers University

Venetian Patent Statute

- The history of patent law is generally considered to have started with the Venetian Patent Statute of March 19, 1474 established in the Republic of Venice as the first statutory patent system in Europe—may be the earliest codified patent system in the world
- Patents might be granted for any new and ingenious device, not previously made, provided it was useful—these principles still remain the basic principles of patent law
- The Venetian Senate granted patents free of payment, about 2000 patents between 1474 and 1788
- Leonardo da Vinci 1452—1519 preferred coded notebooks to relying on the patent laws in their infancy and never obtained a patent

The First U.S. Patent

- Samuel Hopkins 1743—1818 was issued U.S. Patent X000001 on 1790-07-31 for a new apparatus and process of making potash and pearl ash for use in fertilizers
- The patent was signed by President George Washington 1732—1799



X000001
July 31, 1790

The United States.

To all to whom these Presents shall come. Greeting.

Whereas Samuel Hopkins of the City of Philadelphia and State of Pensylvania hath discovered an Improvement, not known or used before such Discovery, in the making of Pot ash and Pearl ash by a new Apparatus and Process, that is to say, in the making of Pearl ash 1st by burning the raw Ashes in a Furnace, 2d by dissolving and boiling them when so burnt in Water, 3rd by drawing off and settling the ley, and 4th by boiling the ley into Salts which then are the true Pearl ash; and also in the making of Pot ash by fluxing the Pearl ash so made as aforesaid; which Operation of burning the raw Ashes in a Furnace, preparatory to their Dissolution and boiling in Water, is new, leaves little Residuum, and produces a much greater Quantity of Salt: These are therefore in pursuance of the Act, entitled "An Act to promote the Progress of useful Arts", to grant to the said Samuel Hopkins, his Heirs, Administrators and Assigns, for the Term of fourteen Years, the sole and exclusive Right and Liberty of using and vending to others the said Discovery of burning the raw Ashes previous to their being dissolved and boiled in Water, according to the true Intent and Meaning of the Act aforesaid. In Testimony whereof I have caused these Letters to be made patent, and the Seal of the United States to be hereunto affixed. Given under my Hand at the City of New York this thirty first Day of July in the Year of our Lord one thousand seven hundred & Ninety.

G. Washington

City of New York July 31st 1790.

I do hereby Certify that the foregoing Letters Patent were delivered to me in pursuance of the Act, entitled "An Act to promote the Progress of useful Arts", that I have examined the same, and find them conformable to the said Act.

Edm: Randolph Attorney General for the United States.

Pioneering Inventions

15 Patents That Changed the World 2018-04-27

- "Electromagnetic inductive suspension and stabilization system for a ground vehicle" US3470828
- "Electronic device" USD672769
- "Locomotion assisting device and method" US8905955
- "Omni-directional, vertical-lift, helicopter drone" US3053480
- "Apparatus for production of three-dimensional objects by stereolithography" US4575330
- "Retinal prosthesis and method of manufacturing a retinal prosthesis" US8527057
- "Navigation system using satellites and passive ranging techniques" US3789409
- "CRISPR-Cas systems and methods for altering expression of gene products" US8697359
- "Three-dimensional electrode device" US5215088
- "Nano-scaled graphene plates" US7071258
- "Peer to peer information exchange for mobile communications devices" US7149534
- "Vision system for an autonomous vehicle" US8139109
- "Apparatus for utilizing solar radiant energy" US389124
- "Mobile internet access" US6618592
- "Virtual reality generator for displaying abstract information" US6073115

Seminal Patents

10 Patents That Launched Billion-Dollar Empires

- Dropbox: "Network folder synchronization" US8825597
- FireEye: "System and method of detecting computer worms" US8528086
- Zynga: "Asynchronous challenge gaming" US8272961
- Square: "Systems and methods for decoding card swipe signals" US8231055
- Facebook: "Dynamically generating a privacy summary" US8225376
- Theranos: "Medical device for analyte monitoring and drug delivery" US8101402
- SolarCity: "Methods for financing renewable energy systems" US7904382
- GoPro: "Harness system for attaching camera to user" US6955484
- Google: "Method for node ranking in a linked database" US6285999
- Apple: "Microcomputer for use with video display" US4136359

4 of the most valuable modern tech patents

- FireEye, Zynga, and SolarCity (see above)
- Amazon: "Method and system for placing a purchase order via a communications network" US5960411 (or "Collaborative recommendations using item-to-item similarity mappings" US6266649)

The most iconic (and patented) toys and games of all time 2018-12-23

Types of Patents

https://www.uspto.gov/web/offices/ac/ido/oeip/taf/patdesc.htm

Type	Description	Term	Maintenance Fee
Utility	The invention of a new and useful process, machine, manufacture, or composition of matter, or a new and useful improvement thereof	20 years from the date of patent application filing	Due 3.5, 7.5, and 11.5 years
Design	A new, original, and ornamental design embodied in or applied to an article of manufacture	15 (14) years from the date of grant for applications filed on or after (before) May 13, 2015	No
Plant	A new and distinct, invented or discovered asexually reproduced plant including cultivated sports, mutants, hybrids, and newly found seedlings, other than a tuber propagated plant or a plant found in an uncultivated state	20 years from the date of patent application filing	No

Criteria for Utility Patents

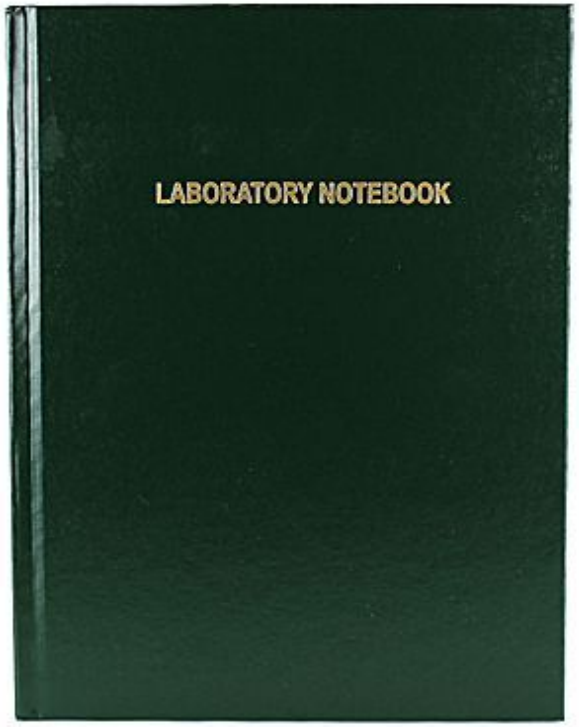
- Novelty
  - The invention must be demonstrably different from the prior art that is all work in the field of the invention
  - Inventors are expected to be familiar with this prior art material
  - Inventors must demonstrate
    - The earliest date of conception of the invention
    - Diligence in reducing it to practice without any period of abandonment
- Usefulness
  - Desired objectives must be achieved by the invention
  - There must be practical utility associated with the invention that is specific, demonstrable, and substantial
- Nonobviousness
  - The invention must have required more than ordinary skill to design or the mere addition/duplication of components found in a patented design
  - The new application of an old design may be patentable

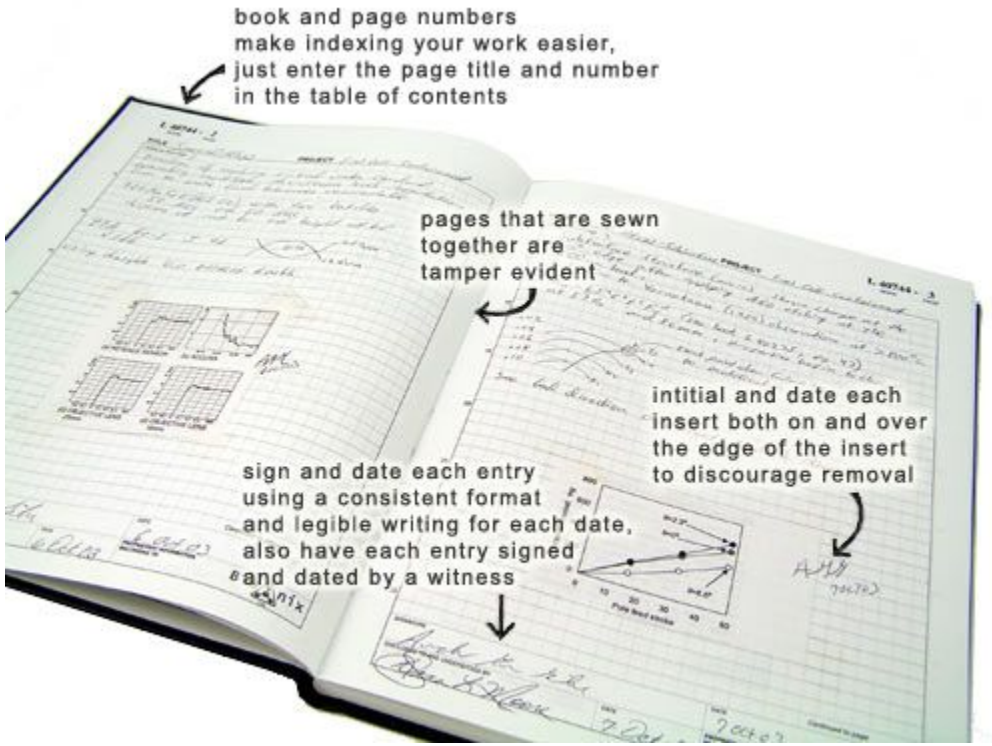
Invention Record Keeping Steps

- Records should be written and kept in a bound laboratory notebook with numbered pages
  - Entries should be in indelible ink and dated
  - Any delays in conducting the work should be explained in writing
  - The advantages and uses of the invention should be identified, together with complete descriptions of the design components and specifications
  - All related papers (correspondence, sales slips, *etc*.) should be saved
  - If a correction is necessary, line through the error and initial and date the change, or (preferably) correct the work on a new page in the notebook and refer to the earlier incorrect entry
  - Later additions should be entered in an ink of a different color, then initialed and dated
  - Sign each page as the inventor and enter the date
- Obtain competent witness of the recording
  - Preferably two or more other persons
  - Inventors cannot serve as witnesses to their own inventions
  - Each witness should sign and date each page of the inventor's notes and sketches as soon as possible
  - Witnesses should not be related to the inventor
  - Witnesses must be available (easily located) in the future
  - An inventor's protection that the witnesses will not steal the work is their signatures as witnesses
  - Witnesses should have the technical training and knowledge to understand the invention and its use

Laboratory Notebook

Example





Patent Disclosures

- Title
- Abstract that summarizes the disclosure and claims
- Specification that identifies
  - Any appropriate previous patents or applications of the inventor that are related to the current application
  - The technical field to which the invention belongs
  - The prior art of the invention to expedite the search and examination of the application by the USPTO
  - The problem and the way in which it has been solved by the invention including all advantages over the prior art
  - Any figures or drawings as needed for a complete description
  - The invention, in the form of a sufficiently detailed and complete description of both its form and its users
  - The claims to be protected by the patent
- Oath or declaration in which the applicant states
  - Belief that he or she is the original and first inventor of the described invention
  - His or her citizenship

Patent Claims

- The claims contained in a patent disclosure determine the legal coverage to be provided
- Each claim is written as a single sentence, beginning with "I (We) claim" or "What is claimed is" only once
- Claims are numbered from the most general to the most specific
- The claims should describe all of the advantages of the design
- One should strive to generate as many claims as possible for an invention to maximize the legal protection provided by the patent
  - The claims must be sufficiently narrow and precise as required by patent law
  - They should also be broad enough to protect all appropriate aspects of the inventor's intellectual property
- Examples
  - Razor by King Camp Gillette 1855—1932, U.S. Patent 775,134 in 1904
  - Velcro by George de Mestral 1907—1990, U.S. Patent 2,717,437 in 1955 with protection on both the process of manufacture and the product itself

Standard-Essential Patents

Standards Developing Organizations (SDOs) such as IEEE require members disclose letters of assurance (LOAs) and license standard-essential patents (SEPs) to users of standards on terms that are "fair, reasonable, and nondiscriminatory" (FRAND)

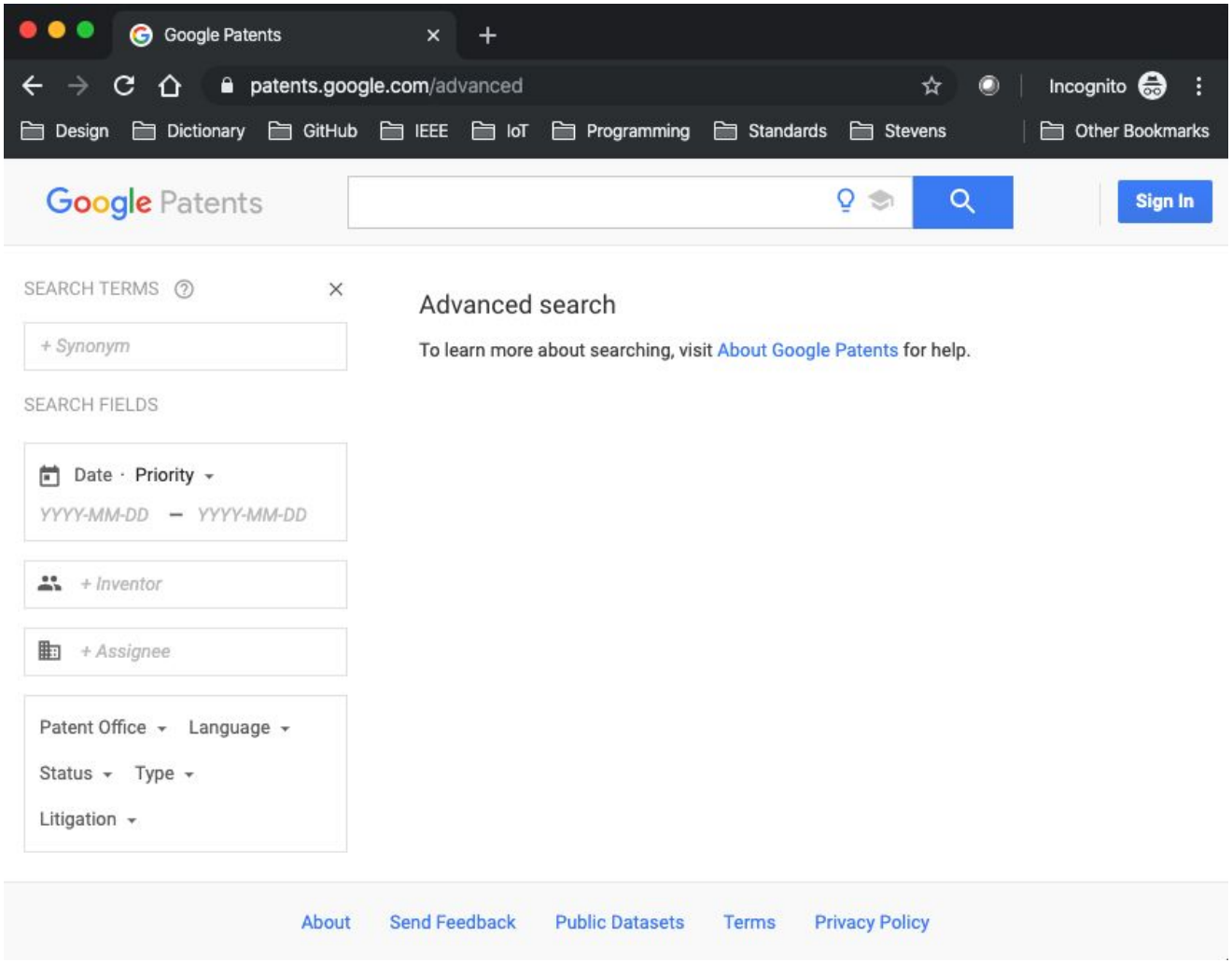
- Must offer to license those patents to all applicants requesting licenses, and cannot pick and choose among licensees
- May not seek, or threaten to seek, injunctions against potential licensees who are willing to negotiate for licenses
- May insist that licensees offer them reciprocal licenses under their own patents
- May arbitrate disputes over FRAND terms
- May charge a reasonable royalty that is based, among other things, on the value that the patented technology contributes to the smallest salable patent-practicing unit (SSPPU) of the overall multi-component product
- Should ensure that subsequent purchasers of these patents agree to abide by the same commitments

Patents and Standards Search

The patent records are a rich pool of technical information

- Ask Patents
- Google Patents and Advanced Patent Search
- Peer to Patent
- USPTO Patent Application Information Retrieval (PAIR) and Seven Step Strategy
- The IEEE Standards Association Records of IEEE Standards-Related Patent Letters of Assurance

Google Patents Advanced Search



Government Patent Use

- The government patent use statute gives the U.S. federal government the right to use patented inventions without permission, while paying the patent holder reasonable and entire compensation for such use and manufacture
  - The United States Code (Table of Contents)
  - Title 28, Judiciary and Judicial Procedure
  - Part IV, Jurisdiction and Venue
  - Chapter 91, United States Court of Federal Claims
  - Section 1498, Patent and copyright cases
- On the other hand, the U.S. Government retains rights in inventions that result from federally funded research and development
  - The government interest statement in the U.S. patents and patent applications:
    "This invention was made with government support under (identify the contract) awarded by (identify the Federal agency). The government has certain rights in the invention."

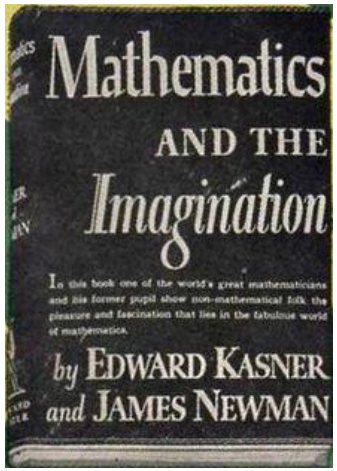
Open Ecosystems

- Industrial Internet Consortium creates Industrial internet of things (IIoT) testbeds and joined with OpenFog Consortium that creates a framework for efficient, reliable networks and intelligent endpoints combined with identifiable, secure, and privacy-friendly information flows between clouds, endpoints, and services
- MIPI Alliance develops Mobile Industry Processor Interface (MIPI) specifications for mobile and mobile-influenced products
- MulteFire Alliance specifies LTE-based technology for operating in unlicensed and shared spectrum
- OpenCAPI Consortium creates Open Coherent Accelerator Processor Interface
- Open Connectivity Foundation (OCF) delivers a standard communications platform, specification, open source implementation, certification program, and Fairhair Specifications for automated buildings and lighting IoT
  - Harald Fairhair 850—932, the first King unified Norway
- OpenPOWER Foundation (OPF) enables data centers to customize IBM POWER microprocessors and system platforms for optimization and innovation
- Wi-SUN Alliance provides IoT wireless interoperability test and certification

Lesson 5 Summary

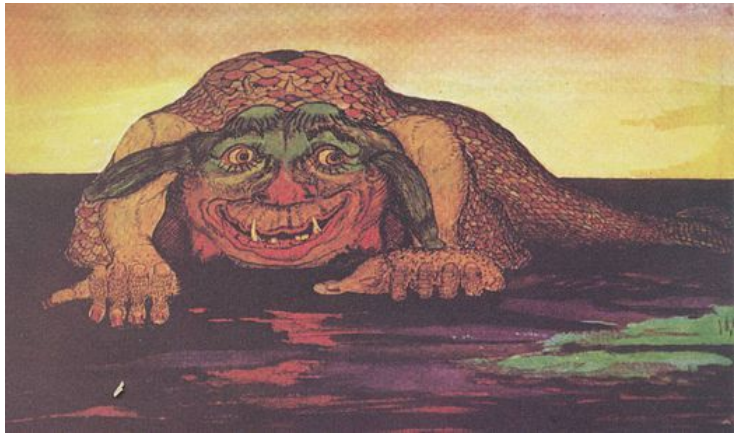
- Design engineers must acquire robust (both broad and deep) technical knowledge and develop the ability to apply it whenever necessary
- There are many sources of valuable technical information with which the engineer should be familiar: manuals, catalogs, books, magazines, journals, and patents
- There are three distinctive types of property: real, personal, and intellectual
- Intellectual property can be protected by trade secret, trademarks, copyrights, or patents
- There are three types of patents: utility, design, and plant
- Criteria used to evaluate utility patent applications include: novelty, usefulness, and nonobviousness
- Engineers and inventors should maintain careful records in anticipation of patent applications
- Patent protection is based on the claims contained in the patent disclosure

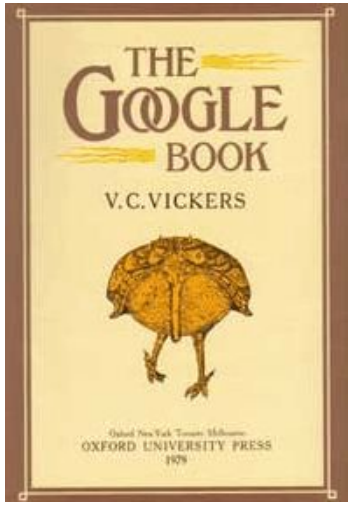
Googol and Googolplex

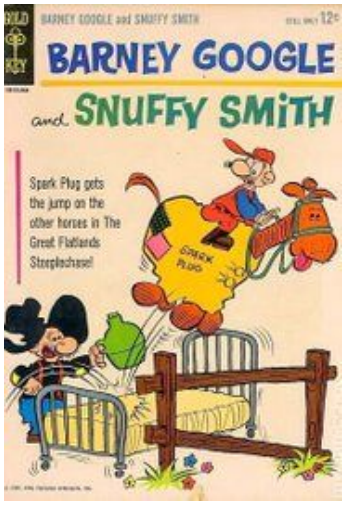


1920: Prof. Edward Kasner 1878—1955 of Columbia University sought a name for 10^{100} and one of his nephews, nine-year-old Milton Sirotta 1911—1981 who might have read *The Google Book* (1913) and/or *Barney Google* (1919), suggested googol (perhaps, three o's resemble 10^{100}) and googolplex "for writing zeros until one gets tired"
1940: Edward Kasner and James Newman 1909—1966 coauthored *Mathematics and the Imagination* that introduced googol for 10^{100} and googolplex for 10^{googol}
1996: Larry Page and Sergey Brin called their search engine "BackRub" for its analysis of the web's backlinks
1997: Larry's officemate, Sean Anderson, suggested a new name Googolplex for BackRub; Larry shortened it to Googol; Sean misspelled Googol as Google in search of the domain name; Larry liked it, and registered Google.com for himself and Sergey on 1997-09-15

Google and Googleplex







1913: Vincent Cartwright Vickers 1879—1939 wrote and illustrated *The Google Book*, a children's book about a strange creature Google and imaginary birds living in Google Land
1919: Billy DeBeck 1890—1942 created a comic strip, *Take Barney Google, F'rinstance*
1923: Billy Rose 1899—1966 wrote the lyrics for "Barney Google (with the Goo-Goo-Googly Eyes)"
1934: The strip became Barney Google and Snuffy Smith with Snuffy as the main character
1997: Larry Page registered the domain name Google.com instead of Googol.com
2002: The first book that Google Books scanned was Vickers' *The Google Book*
2004: Google moved headquarters to the Googleplex

Secret Starlite Formula

- On 1985-08-22, British Airtours Flight 28M caught fire before takeoff at Manchester Airport, England, and 55 people aboard died of toxic smoke in 40 seconds
- Inspired by the incident, Maurice Ward 1933—2011 of Hartlepool, England produced a flame-retardant material named Starlite by his granddaughter
- By the time of his death, Maurice had not patented or successfully commercialized Starlite as a type of intumescent material
- In 2013, Thermashield in California acquired the Starlite formulations, production processes, and original samples and notes
- On 2018-12-19, a YouTube contributor NightHawkInLight published a video attempting to recreate Starlite
- On 2019-05-22, Valley Public Radio aired a program about UC Merced students attempted to recreate Starlite

Led Zeppelin

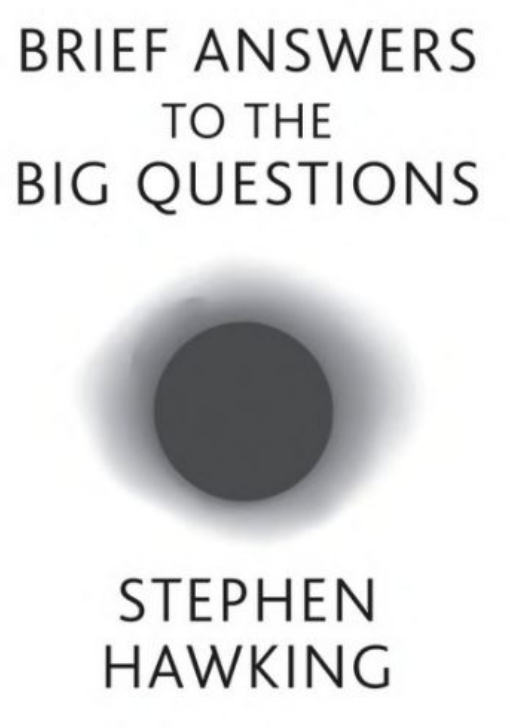
- In 1968, English rock band Led Zeppelin chose their name after Keith Moon, drummer of The Who, told guitarist Jimmy Page that his idea to create a band would "go down like a lead balloon."
- Page's manager Peter Grant suggested changing the spelling of "Lead" to "Led" to avoid mispronunciation
- "Balloon" was replaced with "Zeppelin" as Jimmy Page saw it as a symbol of "the perfect combination of heavy and light, combustibility and grace."
- For the group's self-titled debut album, Page suggested the group use a picture of the Hindenburg disaster on 1937-05-06
- Eva von Zeppelin, a granddaughter of Ferdinand von Zeppelin 1838—1917, once threatened to sue the group for using the name Zeppelin during the 1970 European tour
- LED ZEPPELIN® typed drawing was registered on 1998-12-22 with second renewal on 2018-12-06, and standard character mark was registered on 2013-05-28
- THE LED ZEPPELIN EXPERIENCE® trademark and service mark were registered on 2019-01-29

Boeing 7-7

- How did Boeing come up with the 7-7 name for its commercial jets?
- The Boeing 707 got its numerical name in part because marketing executives felt that the number 707 was catchier than 700
- The Boeing logo, trademarks, and services marks can be used only by written permission from Boeing
- The Boeing copyrighted material (text and images) for other than personal, non-commercial use requires written permission from Boeing
- Mike Lombardi, "Why 7's been a lucky number"
- Use of Boeing Logo, Trademarks, and Copyrighted Materials

Stephen Hawking 1942—2018

Stephen Hawking, "My goal is simple. It is a complete understanding of the universe, why it is as it is and why it exists at all."



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Photograph of the adult Stephen Hawking © Andre Pattenden

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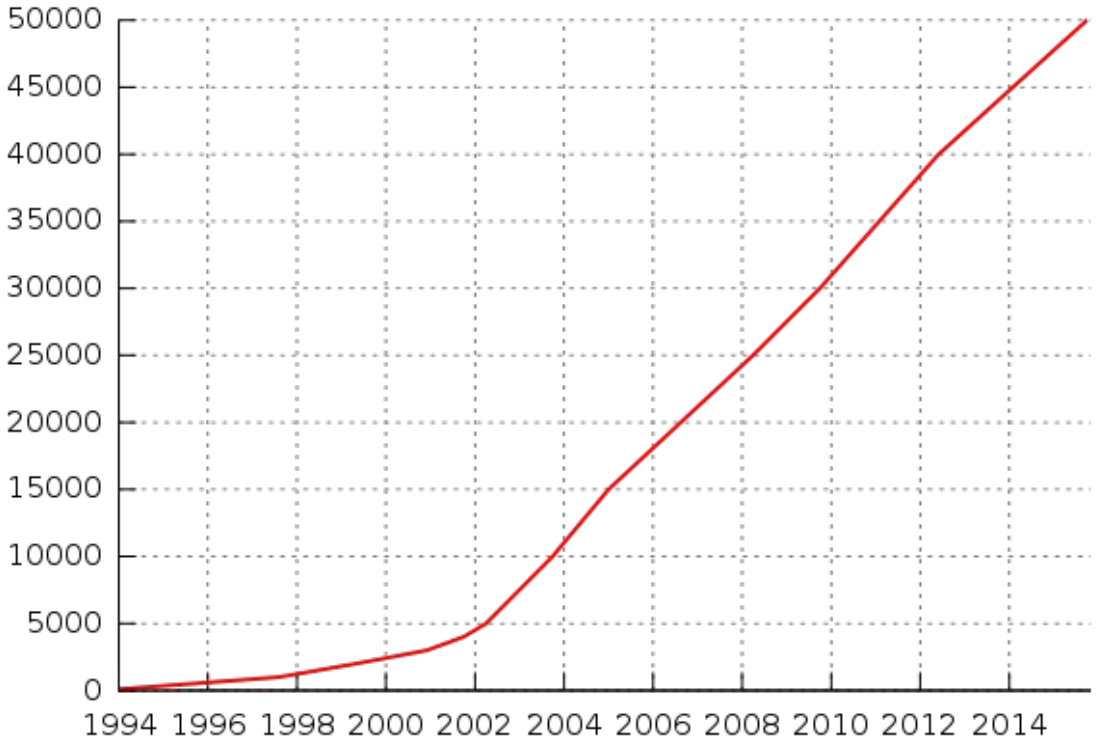


El Cóndor Pasa

- El Cóndor Pasa (Spanish for "The Condor Passes") is an orchestral musical piece from the 1913 zarzuela composed by the Peruvian songwriter Daniel Alomía Robles 1871—1942 based on traditional Andean music, specifically folk music from Peru
- In late 1970, Robles' son Armando Robles Godoy 1923—2010 filed a successful copyright lawsuit against Paul Simon for the 1970 El Cóndor Pasa (If I Could) [lyric] since his father had copyrighted the song in the United States in 1933

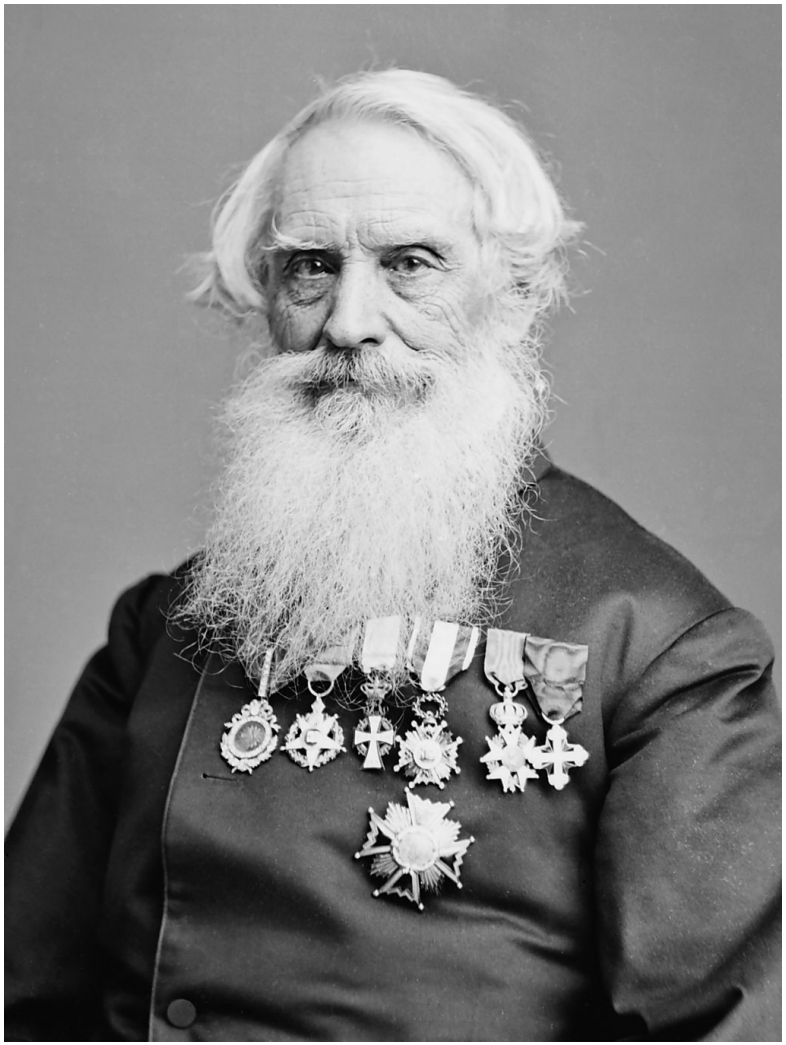
Nyan Cat

- In May 2013, Christopher Torres and Charles Schmidt, the creators of Nyan Cat and Keyboard Cat, respectively, jointly sued 5th Cell and Warner Bros. for copyright infringement and trademark infringement over the appearance of these characters without permission in the Scribblenauts series of video games
- Torres and Schmidt have registered copyrights on their characters and have pending trademark applications on the names
- The suit was settled in September 2013, with Torres and Schmidt being paid for the use of the characters

Cameras and Photography

- Cameras evolved from the camera obscura (Latin for dark room) through many generations of photographic technology to the modern day with digital cameras and camera phones
  - Daguerreotypes (1839) by Louis Daguerre 1787—1851
  - Calotypes or talbotype (1841) by William Henry Fox Talbot 1800—1877
  - Dry plates (1871) by Richard Leach Maddox 1816—1902
  - Film (1885) by George Eastman 1854—1932
- The coining of the word photography in 1839 is usually attributed to John Herschel 1792—1871 who invented cyanotype that became known as blueprints

Samuel Morse 1791—1872



- Samuel F. B. Morse is an American portrait painter and inventor who contributed to the invention of a single-wire telegraph system ("Improvement in the mode of communicating information by signals by the application of electromagnetism" U.S. Patent 1,647 1840) based on European telegraphs such as the Cooke and Wheatstone telegraph
- Morse co-developed Morse code in 1837 and its commercial use for telegraphy in 1844

Charles Wheatstone 1802—1875

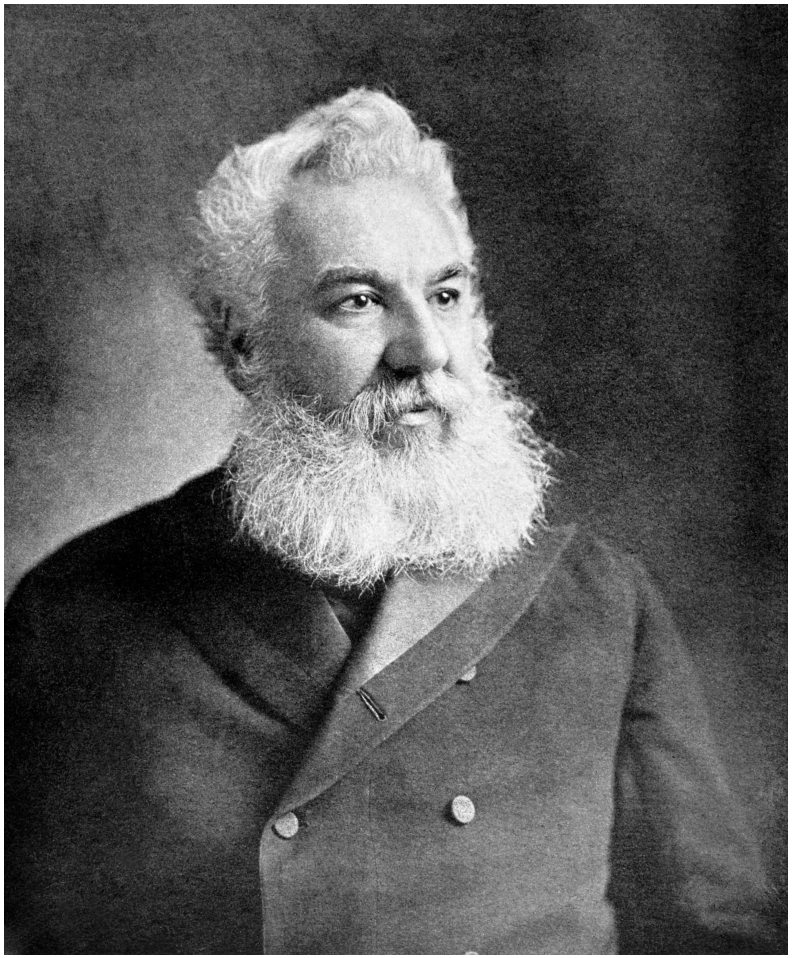
- Charles Wheatstone is best known for his contributions in the development of the Wheatstone bridge in 1843 to measure an unknown electrical resistance, originally invented in 1833 by Samuel Hunter Christie 1784—1865
- The emblem of the IEEE Eta Kappa Nu honor society is a stylized representation of a Wheatstone bridge
- A membership analogy is made in which career success is determined when a balance of scholarship, character, and attitude is achieved
- The name is based on the first, fourth, and last letters of the Greek word ήλεκτρον (elektron) for amber, a material that exhibits electrostatic properties when rubbed

Émile Baudot 1845—1903

- Jean-Maurice-Émile Baudot was a French telegraph engineer and inventor of the first means of digital communication Baudot code and a multiplexed printing telegraph system (U.S. Patent 388,244 1888) that used his code and allowed multiple transmissions over a single line
- The baud unit for symbol rate or modulation rate was named after him

Alexander Graham Bell 1847—1922

Individual Patents That Built Empires 2016-07-25

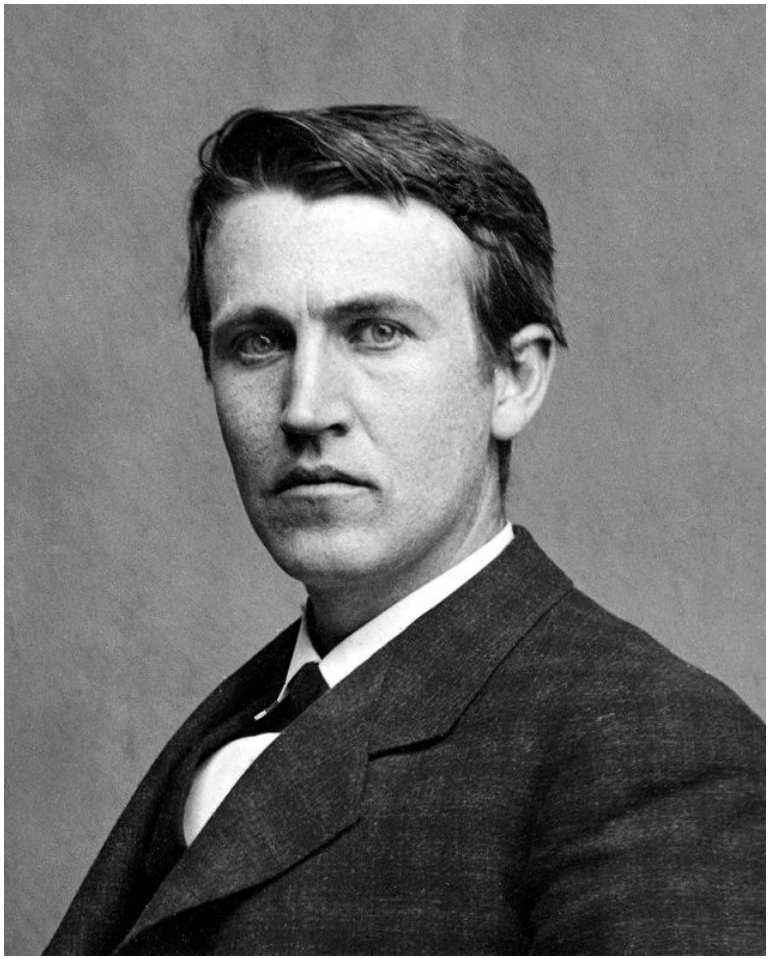


- Alexander Graham Bell was a Scottish-born American inventor, scientist, and engineer
- In 1872, Bell became professor of Vocal Physiology and Elocution at the Boston University School of Oratory
- On 1876-02-14, he filed a patent application and Elisha Gray 1835—1901 filed a patent caveat (similar to a provisional application used today), both relating to telephone
- On 1876-03-07, Bell's "Improvement in telegraphy" was granted US174,465
- Bell acquired Western Electric in 1881 and co-founded American Telephone and Telegraph (AT&T) in 1885

Thomas Edison 1847—1931

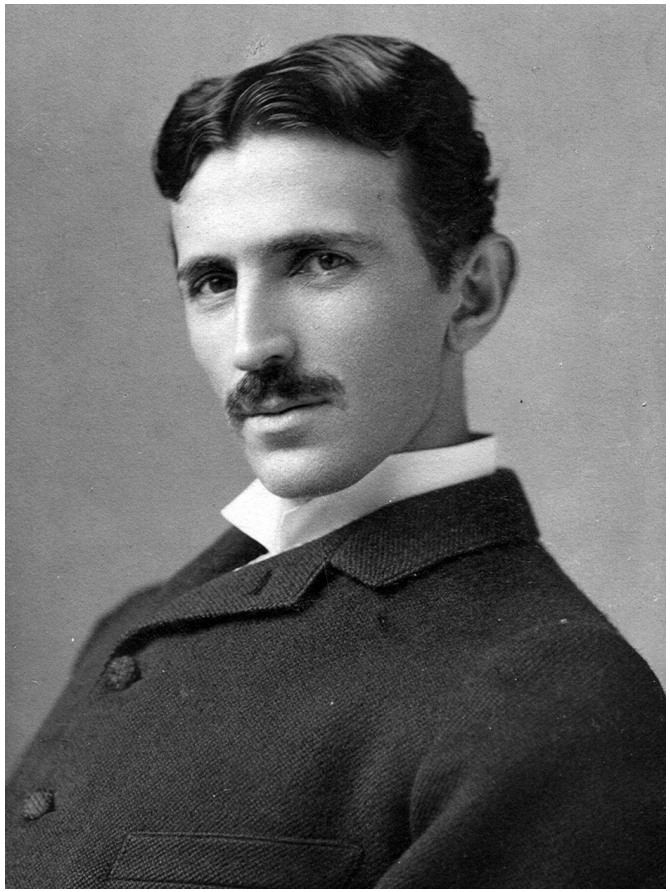
List of Prolific Inventors

- Thomas Alva Edison was widely known as the America's most prolific inventor, even after his death in 1931 (see Top 5 Patent Holders)
- He held a total of 1,093 U.S. patents (1,084 utility patents and 9 design patents)
- In 2003, his patent count was exceeded by Japanese inventor Shunpei Yamazaki
- On February 26, 2008, Yamazaki's patent count was exceeded by Australian inventor Kia Silverbrook
- In 2017, Silverbrook's patent count was exceeded by Yamazaki



Nikola Tesla 1856—1943

- John F. Wasik, *Lightning Strikes: Timeless Lessons in Creativity From the Life and Work of Nikola Tesla* (2016)
- In contrast with Thomas Edison 1847—1931 and George Westinghouse 1846—1914, Tesla's supreme abilities to conceptualize and create entire systems weren't enough for business success
- Tesla didn't manage to build successful alliances with those who could finance, build, and scale up his creations
- Tesla created the AC (Alternating Current) energy system and the basics of radio communication and robotics but wasn't able to bring them all to fruition
- Even for a brilliant inventor, innovation requires a broad spectrum of talents, skills, and lots of capital



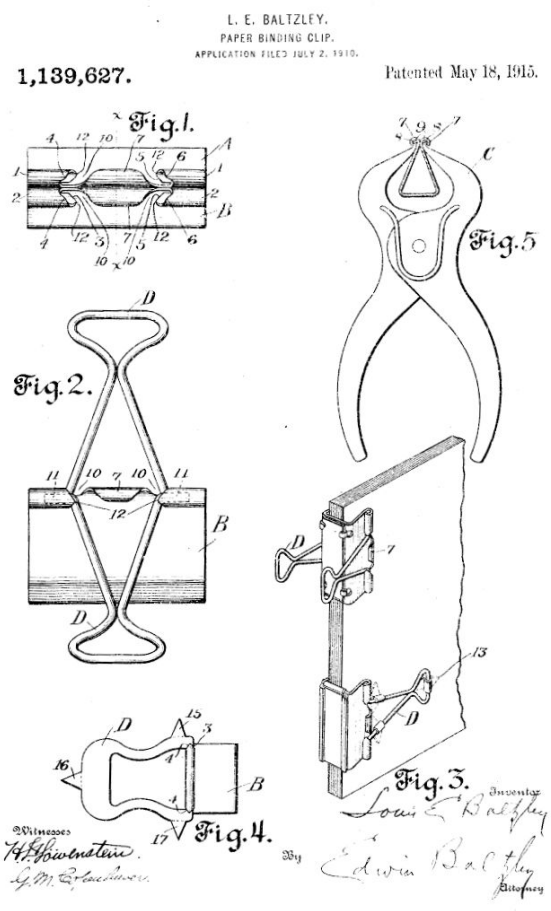
Marie Curie 1867—1934

- Marie Skłodowska Curie was the first woman to win a Nobel Prize (1903 in Physics), the first person and only woman to win twice (1911 in Chemistry), and the only person to win a Nobel Prize in two different sciences
- Her achievements included the development of the theory of radioactivity (a term that she coined), techniques for isolating radioactive isotopes, and the discovery of two elements, polonium and radium, in 1898
- In an unusual decision, she intentionally refrained from patenting the radium-isolation process, so that the scientific community could do research unhindered
- She and her husband, Pierre Curie, often refused awards and medals

Paperclip and Binder Clip

- The Gem paperclip was never patented, likely made since 1870s by Gem Manufacturing Company in Britain
- In 1904, Cushman & Denison registered a trademark for the "Gem" name that had been used since March 1, 1892, which may have been the time of its introduction in the U.S.
- The binder clip was invented by Louis E. Baltzley with the U.S. Patent 1,139,627 in 1915

Published in *The Book-Keeper*, Aug. 1894, p. 6. Discovered by The Early Office Museum (www.officemuseum.com)



Charles F. Kettering 1876—1958

- Charles Franklin Kettering was a founder of Delco, and head of research at General Motors from 1920 to 1947
- Among his most widely used automotive developments were the electrical starting motor (U.S. 1,150,523 filed 1911-06-15 and Patented 1915-08-17)
- While working with the Dayton-Wright Company, he developed the "Bug" aerial torpedo, considered the world's first aerial missile
- He led the advancement of practical, lightweight two-stroke diesel engines, revolutionizing the locomotive and heavy equipment industries
- In 1927, he founded the Kettering Foundation

Garrett Morgan 1877—1963

- With only an elementary school education, Garrett Morgan began his career as a sewing-machine mechanic
- The gas mask he invented in 1912 (U.S. 1,113,675 issued in 1914) was used during World War I to protect soldiers from chlorine gas fumes
- He patented a three-armed signal (U.S. 1,475,024 on November 20, 1923) mounted on a T-shaped pole that indicated "stop" and "go" for traffic in two directions, and also had another signal for stopping traffic in all directions before the stop and go signals changed — the forerunner of today's yellow light

Edith Clarke 1883—1959

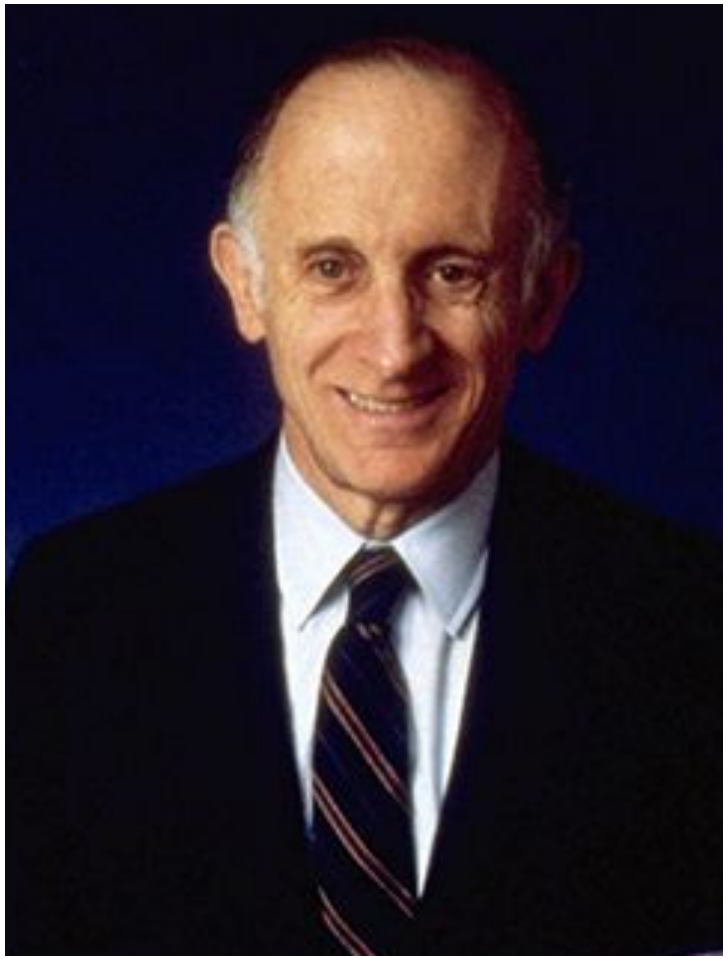
- Edith Clarke was the first woman to earn an M.S. in electrical engineering from MIT in 1919
- Worked for General Electric as a supervisor of computers in the Turbine Engineering Department
- Invented the Clarke calculator, a graphical device that solved equations involving hyperbolic function to simplify calculations for inductance and capacity in power transmission lines
- Filed a patent for the calculator in 1921 and it was granted in 1925 as U.S. 1,552,113
- The first woman to deliver a paper at the American Institute of Electrical Engineers (AIEE) — the AIEE annual meeting in 1926
- The first female professor of Electrical Engineering — the University of Texas at Austin in 1947

Hedy Lamarr 1914—2000

- Hedwig Eva Maria Kiesler, an Austrian and American film actress, co-invented "Secret Communication System" U.S. Patent 2,292,387 in 1941 with American composer and pianist George Antheil 1900—1959
- Using a method similar to the way paper player piano rolls work, they drafted designs for a new frequency-hopping, spread-spectrum technology
- Although the technology wasn't adopted until 1962, the principles are now incorporated into Bluetooth, CDMA, Wi-Fi, ZigBee, *etc*.

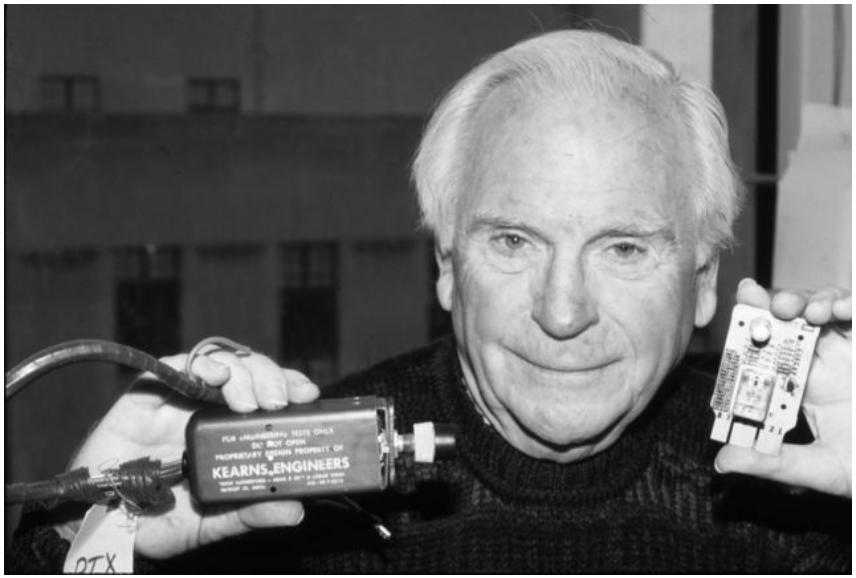
Jerome Lemelson 1923—1997

- Jerome Lemelson was a prolific independent inventor with 605 patents
- From 1957 on, he received an average of one patent a month for more than 40 years, in technological fields related to automated warehouses, industrial robots, cordless telephones, fax machines, videocassette recorders, heat-sealing machine, illuminated highway makers, patient monitoring systems, camcorders, and the magnetic tape drive used in Sony Walkman tape players
- Lemelson and his family established the Lemelson Foundation in 1993, and the Lemelson-MIT Program in 1994



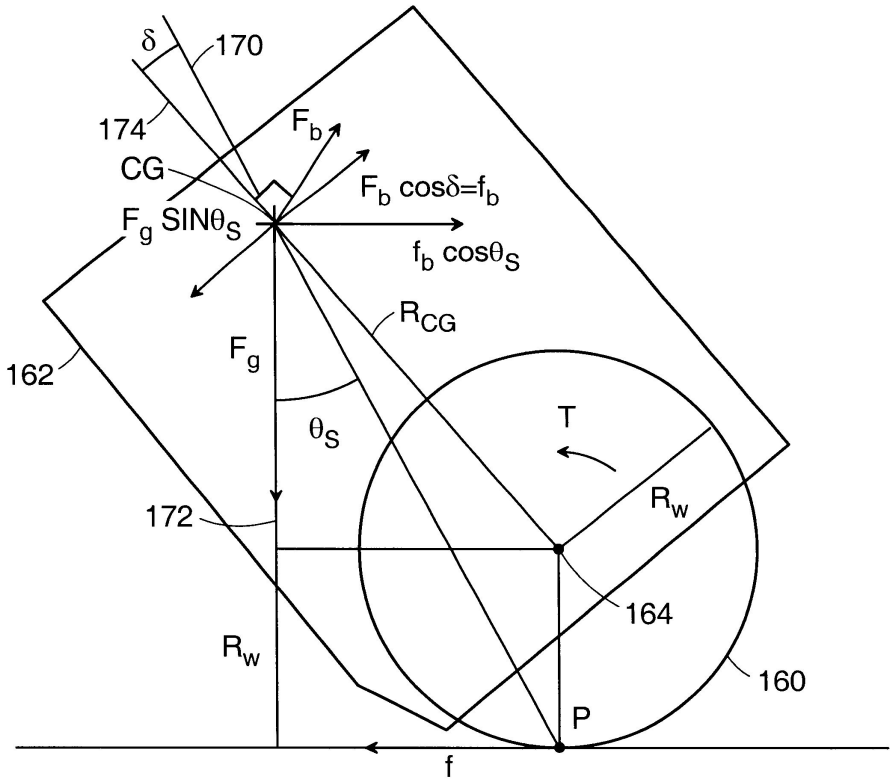
Robert Kearns 1927—2005

- Robert Kearns invented the intermittent windshield wiper systems (U.S. Patent 3,351,836 granted in 1967) used on most automobiles since 1969



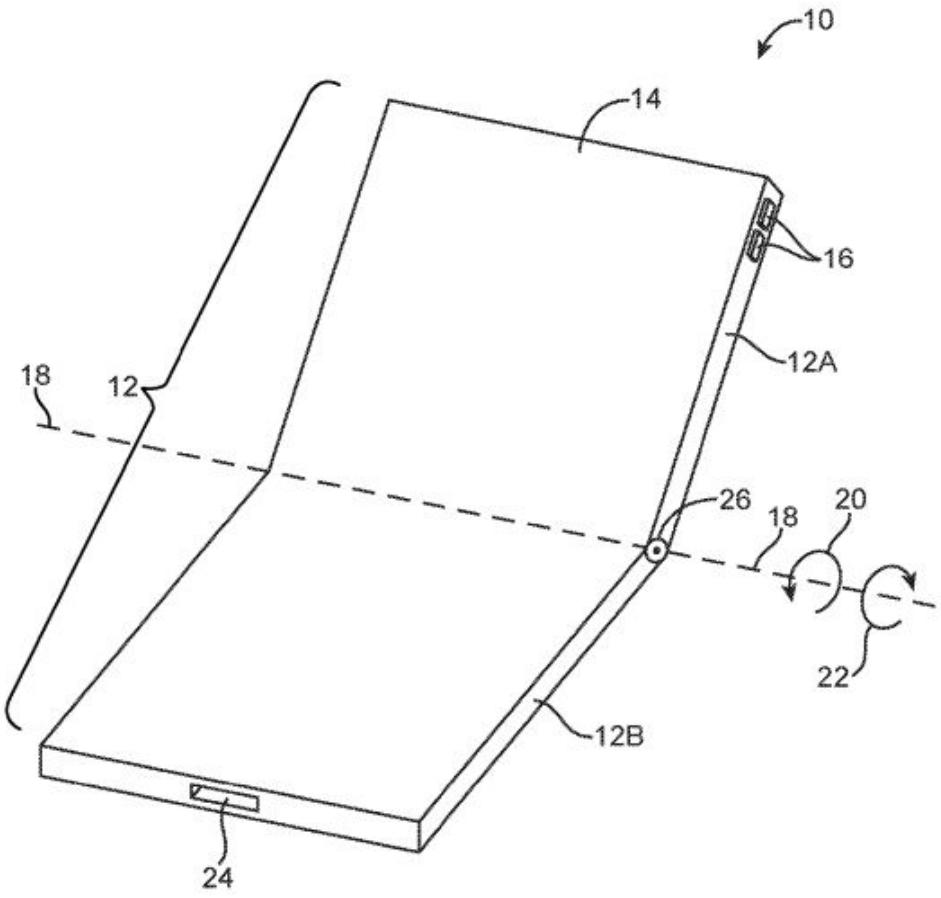
- He won patent infringement cases against Ford Motor Company (1978–1990) and a case against Chrysler Corporation (1982–1992)
- His story inspired the 2008 film "Flash of Genius" titled after the patentability test in effect from 1941 to 1952 that was rejected by Congress in its 1952 revision of the patent statute, now codified in Title 35 of the United States Code
- Section 103 was amended to state the new standard of nonobviousness: "Patentability shall not be negatived by the manner in which the invention was made"

Segue and Segway®



- Segway® battery-powered self-balancing personal transporters (PT) were invented by Dean Kamen *et al*. in patents published since 1997
- Segue is an uninterrupted transition from one piece of music or film scene to another
- Montage is the process or technique of selecting, editing, and piecing together separate sections of film to form a continuous whole
- Segue was adopted into English from Italian, where segue means "there follows"
- "Segue to a new subject" means moving on to a new subject

Flexible Display Devices



- The first flexible display was produced as electronic paper (e-paper) by Nicholas K. Sheridon at Xerox PARC (Palo ALto Research Company) in 1974
- The first practical organic light-emitting diode (OLED) was built in 1987
- In 2008, Nokia conceptualized flexible OLED displays in mobile phone
- On 2019-02-14, Apple filed a patent application on "Flexible Display Devices" US20190053388A1

Patent Wall

The World's 50 Most Innovative Companies 2018-01-12